3.6 The mighty chain rule

used to take the derivative of a composite function.

Composite function:

function of a function

$y = \sin(x^5)$ $\quad$ $y = f(g(x))$

outside, inside

out, in

$$y = \tan(x^2+2x+1)$$

$$y' = (2x+2)\sec^2(x^2+2x+1)$$

$$y = \sec^3 x = (\sec x)^3$$

out

in

$$y' = \sec x \tan x \cdot 3(\sec x)^2$$

outside: u^3

der: $3u^2$

$$y = (x^2 + 2x + 1)^7$$

$$y' = (2x+2)\left[7(x^2+2x+1)^6\right]$$

$$y = x^3 \cdot (x^2+2x+1)^7$$

$$y' = 3x^2 \cdot (x^2+2x+1)^7 + x^3 (2x+2)7(x^2+2x+1)^6$$

#149 chain rule

$(f \circ g)'(x)$

$y = f(g(x))$ | $y' = g'(x)\, f'(g(x))$

der of out

der of inside

$u = g(x)$

$y = f(u)$

$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$

$$y = \sin(x^5)$$

$$y = \sin(u) \qquad u = x^5$$

$$y' = 5x^4 \cos(x^5)$$

(u)

$$\frac{dy}{dx} = \frac{dy}{du}\,\frac{du}{dx}$$